GSFC 424-28-26-01
Revision B

PHASE C/D WORKING AGREEMENT

BETWEEN

JET PROPULSION LABORATORY

AND

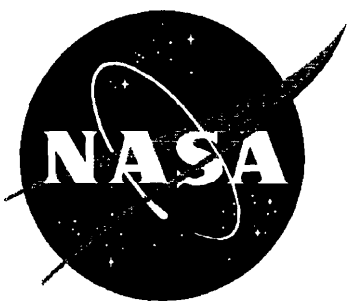
GODDARD SPACE FLIGHT CENTER

FOR

DEVELOPMENT OF THE TROPOSPHERIC EMISSION SPECTROMETER FLIGHT INSTRUMENT

(JPL Task Plan No. 70-5 17 1, Rev. B)

December 2002



GODDARD SPACE FLIGHT CENTER
GREENBELT, MARYLAND

PHASE C/D WORKING AGREEMENT

between

JET PROPULSION LABORATORY

and

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for

DEVELOPMENT OF THE
TROPOSPHERIC EMISSION SPECTROMETER FLIGHT INSTRUMENT

JPL Task Plan No. 70-5 17 1, Rev. B

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CHANGE RECORD PAGE

DOCUMENT TITLE: Phase C/D Working Agreement between Jet Propulsion Laboratory and Goddard Space Flight Center for Development of the Tropospheric Emission Spectrometer Flight Instrument

DOCUMENT DATE: December 2002

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Revision B	12102	All	Approved by CCR #424-1 2-26-024

EOS 420-CM-05 (4/92)

DOCUMENT TITLE: Phase C/D Working Agreement between Jet Propulsion Laboratory and Goddard Space Flight Center for Development of the Tropospheric Emission Spectrometer Flight Instrument

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1. Introduction

This Working Agreement is established between the Jet Propulsion Laboratory (JPL) Tropospheric Emission Spectrometer (TES) Project and the Goddard Space Flight Center (GSFC) Earth Observing System (EOS) Aura Project to set forth the mutually agreed GSFC and JPL responsibilities for TES instrument development.

2. Scope

This Working Agreement covers the development of the TES flight instrument for the Aura mission. Being added to the agreement via Revision A are the two additional UPN's that share JPL's Task Order No. These additional UPN's cover the science, algorithm development, and flight operations aspects of the TES experiment up to launch plus 90 days.

3. Applicable Documents

The documents are listed in order of precedence. Specific agreements or custom tailoring of requirements that are satisfactorily negotiated to resolve precedence conflicts will be clearly documented for the record. Other documentation and correspondence will be generated and maintained as required to provide an accurate record of mutually agreeable clarifications and refinements to these documents. Issues related to the MAR, Item #6 will be handled in this manner and are documented in a letter dated April 9, 1998, from the Aura Project Manager and concurred with by the JPL ESFE Program Manager.

1. EOS Chemistry Project Plan, 424- 1 O-O 1-O 1, 4/15/99
2. Documents Requirements List for the TES, GSFC 424-28-26-03, Baseline Release (dated 4/30/98)
3. Unique Instrument Interface Document (UIID) for the TES, GSFC 424-28-26-02, Original Release (dated 4/98) + Approved Changes 01-05
4. General Interface Requirements Document (GIRD) for EOS Common Spacecraft/Instruments, GSFC 422- 11-12-o 1, Revision B (dated August 1998) + Approved Change 01
5. Interface Control Document for the Tropospheric Emission Spectrometer (TES), TRW Document No. D26476, Rev. B (dated July31, 2000)
6. Mission Assurance Requirements (MAR) for the TES and MLS, GSFC 424-l 1 - 13-02, Baseline Release (dated 1 l/l 3/96)
7. TES Instrument Performance Requirements, JPL D-14515, Rev. B (dated June 23, 2000)
8. EOS CSFP Instrument Software Management Requirements Document, GSFC 424-28- 1 l-01 (Guideline use only), Original Release (dated March 31, 1995) + Approved Change 0 1

4. Implementation Responsibility

4.1 Instrument Development

The TES instrument will be developed in-house at JPL. The instrument will meet the requirements in the TES Instrument Performance Requirements document (Applicable Document No. 7).

In conducting this effort, JPL shall provide the personnel, materials, services, and facilities required to conceive, design, analyze, fabricate, assemble, test, calibrate and deliver one flight instrument and one set each of associated Ground Support Equipment (GSE), including Mechanical GSE (MGSE) and Electrical GSE (EGSE), and Assembly, Handling, Shipping and storage Equipment (AHSE) for the Aura mission. JPL will also provide to GSFC the technical and management information required for this effort, either as a deliverable item specified in the Documents Requirements List for the TES or as requested.

JPL will provide technical support and participate in Working Groups for mission interfaces, spacecraft integration and test, calibration, and launch and mission operations as necessary to develop the TES instrument and coordinate with GSFC for the Aura mission. Following delivery of the instrument, JPL will provide field support at locations to be designated by GSFC for spacecraft integration and test, launch, and in-flight checkout. Field support will be a level-of-effort activity as defined in Paragraph 6. All TES-provided GSE and AHSE items will be returned to JPL at the completion of spacecraft integration, test, and launch activities.

4.2 Instrument Mode/ Definitions

JPL will design, fabricate and test various units as defined in this section.

4.2.1 Breadboards

JPL will develop and test breadboards of critical components and subsystems as necessary to demonstrate the feasibility and improve the understanding of technologies identified as being high risk and/or having a significant negative impact to the TES mission in the event of a full or partial failure. JPL will also develop and test breadboards of instrument assemblies as necessary for performance assessments.

4.2.2 Engineering Mode/

JPL shall develop engineering model hardware that will demonstrate critical technologies. The “Engineering Model (EM)” hardware includes:

1. The interferometer (including a motor, encoder and drive electronics), with one laser and laser detector.
2. A cooler, one engineering test unit focal plane dewar with a resistor as a focal plane, one filter wheel, one filter and one set of signal chain assemblies. The

resistor is the same resistance as the cold focal plane and provides an equivalent (but slightly better) measurement of noise coupling.
3. A Calibration Subsystem.
4. A Pointing Control Subsystem.
5. Engineering Data Interface Board.
6. Spacecraft Interface Board.
7. Power Supply Boards.
8. Limited emulators for spacecraft interface simulation (High Speed Simulator (HSS) with TAXI interface, 1553 interface, gyro interface, power interface).

The objectives to be accomplished using this EM hardware include:
1. Demonstration of interferometer performance and operation through velocity control and laser fringe measurement.
2. Operation of the focal plane and demonstration of acceptable EM1 performance of the cooler with the focal plane electronics in a vacuum chamber at operating temperature and pressure.
3. Verification of basic operation of the Calibration Subsystem.
4. Verification of electronic board internal and spacecraft interfaces and performance.
5. Verification of the flight software to communicate with the spacecraft interface and control board operation.

This testing shall demonstrate the primary interferometer functionality, demonstrate critical electronic and software functionality, and provide a demonstration of the more difficult aspects of instrument integration and test. This testing, coupled with thermal analysis shall be sufficient to verify the overall interferometer thermal design.

4.2.3 Flight Mode/

The flight model instrument will be of protoflight quality as defined by the applicable documents.

4.2.4 Risk Reduction Hardware and Test

JPL will provide a second set of flight interferometer assembly composite hardware and rollers and will also perform a cooler focal plane EM1 test, both for risk reduction.

4.3 *Spares*

JPL will establish and maintain a spares inventory which ensures a quantity of spare parts and higher level subassemblies appropriate and sufficient to expedite servicing or repair of the instrument.

4.4 Shipping/Storage Container

Storage of the instrument for extended periods may be necessary during spacecraft I&T activities. JPL will provide a securable and environmentally suitable container for instrument storage with devices to monitor the container's internal environment. GSFC

will provide for a securable and environmentally suitable area in which to store the container. Storage procedures will be mutually developed between the EOS Aura Project and TES project.

4.5 Algorithm Development

The science investigation and algorithm development now included covers the development and review in prior fiscal years of the Algorithm Theoretical Basis Documents (Applicable Document No. 2) and the Science Computing Facility set up to support this work. The cost elements for these efforts have been added to the Working Agreement to make the Task Order current.

JPL will develop and test the set of Level 2 and Level 3 at-launch algorithms for the retrieval of the atmospheric parameters as identified in the Earth Observing System (EOS) Aura Project Plan (Applicable Document No. 1). JPL will develop plans and procedures to ensure the integrity of instrument operations on orbit. This effort will include the development and test of Level 1 processing algorithms and associated instrument calibration parameters.

The JPL TES Science Team will develop plans for data analysis, including plans for producing science results and processing of science data. The JPL TES Science Team will also support pre-launch and post-launch validation activities as necessary or requested by the Aura Project.

JPL will provide to GSFC the technical and management information required for these efforts, either as a deliverable item specified in the Documents Requirements List for TES (Applicable Document No. 2) or as requested. JPL will also provide technical support to, and participate in Working Groups for these activities as necessary to coordinate TES work with the Aura Project Science team.

5. Reviews & Reports

5.7 Reviews

JPL will prepare and present the following formal instrument reviews. (Dates and contents of these reviews will be in accordance with the DRL.)

1. Preliminary Design Review (PDR)
2. Critical Design Review (CDR)
3. Pre-Environmental Review (PER)
4. Pre-Ship Review (PSR)

JPL will also support special instrument status reviews as required, including, but not limited to, Spacecraft-to-Instrument Interface Meetings and Mission Operations Working Group Meetings.

In addition, JPL will provide management reviews for GSFC nominally once each calendar month at a time and place to be mutually determined by the GSFC Instrument Manager and the JPL Project Manager.

5.2 Reports

JPL will provide the following periodic reports:

	Report	Period
1.	Written Project Management Report (PMR)	Monthly
2.	Informal Reports (By telephone call or electronic mail)	Weekly

6. Assumptions

The provisions of this Working Agreement are based on several assumptions:

1. GSFC will separately fund, through the Science UPN (229), the science, data processing software, and instrument operations aspects of the TES experiment after launch plus 90 days.
2. GSFC will provide funding in a timely manner.
3. Carryover obligation authority at the start of a new fiscal year will be sufficient to fund the TES Project at the required obligation rate until funds for the new fiscal year are on contract at JPL, assumed for planning purposes to be the first 10 weeks of the government fiscal year.
4. Level of effort field support will accommodate the following requirements:
   a) Spacecraft Integration & Test — 10 weeks 3 shifts per day, and 6 weeks of 5 single shift days each, all at TRW
   b) Launch site operations — 3 weeks 3 shifts per day at Vandenberg Air Force Base
   c) 90 day post-launch Mission Operations support — 4 workmonths over 90 day period

   If the level of field support required by GSFC exceeds the level identified above, additional funds will be allocated by GSFC to cover the associated costs.
5. An engineering model of the instrument as defined above will be built and tested, but not delivered.
6. The TES instrument will be developed under JPL institutional requirements as specified by the JPL Space and Earth Science Programs Directorate and will satisfy, as a minimum, the overall quality and reliability requirements of the GSFC Mission Assurance Requirements Document as described in Section 3.0.

7. JPL, TRW and the Aura Project Office will jointly perform an electrical interface test at TRW with the software development and validation facility (SDVF) and the TES engineering model instrument electronics module and required support equipment.
8. All flight spare hardware will be available and stored at JPL.
9. Mechanical Ground Support Equipment (Assembly, Handling, storage and Shipping Equipment (AHSE)) and Electrical Ground Support Equipment (EGSE) consisting of Instrument Ground Support Equipment (IGSE) and the IGSE Software and Operating Manual will be provided by JPL and will be available to support spacecraft level integration and test.
10. Deliverable items which are not equipment are listed in the Document Requirements List (DRL) and are therefore, not listed in Section 7.2
11. The EOS TES Instrument Performance Requirements (D- 14515), Applicable Document 7 in Paragraph 3, will be under JPL change control.
12. JPL will participate in, support, and resolve all issues arising from independent verification and validation (IV&V) of the instrument flight software.
13. JPL will develop, test and support a command and telemetry data base in the EPOCH format.

7. Deliverables

JPL and GSFC will support the delivery and receipt of flight and non-flight items in accordance with the following schedule.

7.1 Deliverables from the Aura Project to TES

All Government Furnished Equipment (GFE) will be accompanied by the appropriate documentation.

	Deliverable	Delivery Date	Quantity
1.	Test kinematic mounts PFM	4/21/00	1 set

7.2 Deliverables from TES to the Aura Project

	Deliverable	Delivery Date	Quantity
1.	Mounting hole drill template	11/01/00	1
2.	PFM Instrument Acceptance Data Package (DRL Item Number 526)	No earlier than 1/31/03 No earlier than 1/31/03	1 Per DRL

	Deliverable	Delivery Date	Quantity
3.	Flight Software Flight Software in EEPROM, PROMs, & FPGAs Instrument Operating Command and Telemetry Data Base Supporting documentation	No earlier than 1/31/03 PER + updates PER + updates1/31/03	1 set 1 1 set
4.	Flight electrical bulkhead connectors with connector savers (spacecraft half of each instrument-to-spacecraft harness connector to be provided to spacecraft provider as flight spare)	No earlier than 1/31/03	1 set
5.	Flight spare hardware (available but not delivered)	N/A	1 set
6.	Mechanical Ground Support Equipment (Assembly, Handling, storage and Shipping Equipment -- AHSE)	No earlier than 1/31/03	1 set
7.	Electrical Ground Support Equipment Instrument Ground Support Equipment (IGSE) IGSE Software and Operating Manual	No earlier than 1/31/03 No earlier than 1/31/03	1 set 1
8.	Algorithms (ATBD Final Release) for Level 1 and 2	6/02	1 set

7.3 Logis tics

GSFC will establish the logistics guidelines for the exchange of flight and non-flight hardware items between JPL and GSFC at a later date. Fundamental in these guidelines for shipments within the U.S. is that the initiator of a shipment will be solely responsible for the shipment's arrival at its destination. This guideline will apply to both commercial and government bills of lading (GBL) shipments.

8. Schedules

JPL will provide schedules suitable for use by GSFC. These schedules will be in a detail sufficient to monitor progress on a monthly basis.

JPL will implement a scheduling system that provides:

a. Detailed logic network schedule with horizontal and vertical links available electronically. This network data will include all activities and milestones that identify, end-to-end, all work required to accomplish the objectives of this Working Agreement. It must provide logic for and visibility into the design, manufacturing, integration, and tests through delivery to the spacecraft at a

level of detail sufficient for the integration of cost and schedule. Critical paths will be identified in the network.

b. Gantt-like charts showing selected current milestones, including other activities such as TES Project internal studies.

JPL and GSFC will mutually determine milestones from the TES logic networks for use in the Aura Master Project Schedule. These will be considered GSFC reportable milestones in that impending schedule slippage from the latest milestone date will be promptly reported to GSFC. The milestones will include the reviews listed in Section 5.1 and instrument delivery to the spacecraft. Other milestones will be chosen from all subsystems and will cover all years.

9. Resources

9.1 Financial Resources

GSFC will provide funds as specified in Table 9-l series of tables which **Profile NOA, Obligations and Cost by UPN;** these funding profiles are an integral assumptions of this Working Agreement. The funding shown is consistent with the current best estimates of the funds available to GSFC to conduct the Aura mission; however, both JPL and GSFC recognize the uncertainty of future year funding authority and anticipate re-negotiation of the scope and funding profiles in this Working Agreement if the NOA on the Table 9-l series are adjusted. **The Table 9-2 series of tables are element of cost profiles by UPN.**

Table 9-la Profile of TES Instrument Development, NOA and Cost

All Costs in Millions of Dollars (UPN 228)	NASA-12601	NASA-I 407				
ITEMS	Prior Actuals	FY'99 Actuals	FY'OO Actuals	FY'01 Actuals	FY'02 Plan	FY'03 Plan
Workforce (Yrs)	172.4	76.6	70.4	62.3	40.5	16.6
JPL Labor Costs	13.0	4.9	4.1	4.0	2.8	1.2
Cat A Contractors	3.2	1.0	1.1	0.9	0.7	0.9
Travel	0.2	0.2	0.1	0.0	0.0	0.0
Services	3.21	3.71	4.11	4.81	2.61	0.01
Procurements	1.2	1.2	1.4	0.7	0.2	0.0
Subcontracts	22.5	21.4	7.5	3.0	0.8	0.1
Multi-Project Support (MPS)	0.0	0.1	0.1	0.1	0.1	0.0
Total Direct Costs	43.3	32.3	18.4	13.5	7.2	2.3
Burden Costs	7.3	8.4	7.1	6.3	4.5	1.8
Total JPL Costs	50.6	40.7	25.5	**19.8**	**11.6**	**4.1**
Incentive Award	0.0	1.2	0.3	0.3	0.1	0.1
Total Estimated Cost	50.6	**41.9**	**25.6**	**20.1**	**11.8**	**4.2**
NOA	**50.6**	**49.7**	**21.1**	***20.3***	***9.2***	***4.2***

All Costs in Millions of Dollars (UPN 228)		For Information Only				
ITEMS	FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan	Runout Total all Years
Workforce (Yrs)	6.9					**445.6**
JPL Labor Costs	**0.8**					**30.7**
Cat A Contractors	0.0					7.8
Travel	0.0					**0.6**
Services	0.0					18.4
Procurements	0.1					4.7
Subcontracts	0.1					55.3
Multi-Project Support (MPS)	0.0					0.4
Total Direct Costs	**0.9**	**0.0**	**0.0**	**0.0**	**0.0**	**117.9**
Burden Costs	0.9					36.3
Total JPL Costs	**1.8**	**0.0**	**0.0**	**0.0**	**0.0**	**154.2**
Incentive Award	0.0					2.0
Total Estimated Cost	**1.8**	**0.0**	**0.0**	**0.0**	**0.0**	**156.2**
NOA	1.2					**156.2**

• Launch plus 90 days

* Carryover obligation authority at the start of a new fiscal year will be sufficient to fund the TES Project at the required obligation rate until funds for the new fiscal year are on contract at JPL, assumed for planning purposes to be the first ten weeks of the government fiscal year.

** NOA Requested by JPL is calculated as follows: planned current year obligation + carryover (to) - carryover (from)

† The funding shown is consistent with the implementation plan which forms the basis for this Task Plan. However, both JPL and GSFC recognize the uncertainty of future year funding authority and would anticipate re-negotiation of the scope of the implementation plan and funding profiles in this Task Plan if the NOA is adjusted. In addition, obligation authority actually provided to JPL in each fiscal year will be assessed and adjusted based upon actual cost performance during each fiscal year.

Table 9-lb Profile of TES Science/SCF NOA and Cost

Cost inception to L+90 days
All Costs in Millions of Dollars (UPN 229)

ITEMS	NASA-1260 Prior Actuals	FY'99 Actuals	FY'00 Actuals	NASA-1 407 FY'01 Actuals	FY'02 Plan	FY'03 Plan
Workforce (Yrs)	1.5	20.5	22.7	30.7	33.9	20.0
JPL Labor Costs	4.5	1.3	1.5	2.2	2.2	2.6
Cat A Contractors	0.0	0.0	0.0	0.0	0.2	0.2
Travel	0.1	0.1	0.1	0.1	0.1	0.1
Services	0.1	0.0	0.0	0.1	0.1	0.0
Procurements	0.2	0.2	0.5	3.2	0.2	0.2
Subcontracts	2.5	1.3	1.7	0.2	2.9	1.6
Multi-Project Support (MPS)	0.0	0.0	0.0	0.0	0.1	0.4
Total Direct Costs	**7.4**	**2.9**	**4.0**	**5.8**	**5.8**	**5.1**
Burden Costs	1.6	1.8	2.3	3.3	3.9	1.2
Total JPL Costs	**9.0**	**4.7**	**6.2**	**9.2**	**9.8**	**6.4**
Incentive Award	0.0	0.2	0.1	0.1	0.1	0.1
Total Estimated Cost	**9.0**	**4.9**	**6.3**	**9.3**	**9.9**	**6.5**
NOA	***8.6***	***5.6***	***7.7***	***9.5***	***8.6***	***6.9***

. NOA FY'03-FY'08 reflects Mike King's guidelines sent April 2002

Cost inception to L+90 days
All Costs in Millions of Dollars (UPN 229)

ITEMS	For Information Only FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan
Workforce (Yrs)	12.1				
JPL Labor Costs	1.7				
Cat A Contractors	0.1				
Travel	0.1				
Services	0.0				
Procurements	0.2				
Subcontracts	1.7				
Multi-Project Support (MPS)	0.3				
Total Direct Costs	**4.1**	**0.0**	**0.0**	**0.0**	**0.0**
Burden Costs	0.9				
Total JPL Costs	**5.0**	**0.0**	**0.0**	**0.0**	**0.0**
Incentive Award	0.0				
Total Estimated Cost	**5.0**	**0.0**	**0.0**	**0.0**	**0.0**
NOA	***4.1***				

. Launch plus 90 days

Operations after L+90 days
All Costs in Millions of Dollars (UPN 229)

ITEMS	For Information Only FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan	Runout Total all Years
Workforce (Yrs)	8.6	15.2	12.0	9.7	7.4	194.3
JPL Labor Costs	1.1	2.2	1.8	1.5	1.1	239
Cat A Contractors	0.1	0.2	0.2	0.2	0.2	[illegible]
Travel	0.0	0.1	0.1	0.1	0.1	1.0
Services	0.0	0.0	0.0	0.0	0.0	0.4
Procurements	0.0	0.1	0.1	0.1	0.1	5.1
Subcontracts	0.0	0.7	0.6	0.2	0.2	13.5
Multi-Project Support (MPS)	0.2	0.4	0.3	0.3	0.2	2.3
Total Direct Costs	**1.4**	**3.6**	**3.0**	**2.3**	**1.8**	**47.2**
Burden Costs	0.4	1.0	0.7	0.5	0.4	18.1
Total JPL Costs	1.81	4.61	**3.71**	**2.81**	**2.2**	**65.3**
Incentive Award	0.01	0.11	**0.01**	0.0	0.0	0.9
Total Estimated Cost	1.9	**4.6**	**3.7**	**2.8**	**2.3**	**66.3**
NOA	2.91	**4.21**	**3.71**	**2.8**	*1.8*	**66.3**

. Cost for Phase E

* Carryover obligation authority at the start of a new fiscal year will be sufficient to fund the TES Project at the required obligation rate until funds for the new fiscal year are on contract at JPL, assumed for planning purposes to be the first ten weeks of the government fiscal year.

† The Science/ SCF funding shown is consistent with the yearly guideline direction provided by M. D. King, EOS Senior Project Scientist, which forms the basis for this Task Plan. However, both JPL and GSFC recognize the uncertainty of future year funding authority and would anticipate re-negotiation of the scope and funding profiles in the Task Plan if the NOA is adjusted. In addition, obligation authority actually provided to JPL in each fiscal year will be assessed and adjusted based upon actual cost performance during each fiscal year.

Table 9-3a Profile of TES Validation NOA and Cost

Cost inception to L+90 days
All Costs in Millions of Dollars (UPN 291)

ITEMS	NASA-1260 Prior Actuals	NASA-1407 FY'99 Actuals	FY'00 Actuals	FY'01 Actuals	FY'02 Plan	FY'03 Plan
Workforce (Yrs)	0.3	1.3	0.9	1.6	2.2	1.6
JPL Labor Costs	0.0	0.1	0.1	0.1	0.2	0.2
Cat A Contractors	0.0	0.0	0.0	0.0	0.0	0.0
Travel	0.0	0.0	0.0	0.0	0.0	0.0
Services	0.0	0.0	0.0	0.1	0.1	0.0
Procurements	0.1	0.0	0.0	0.1	0.1	0.0
Subcontracts	0.0	0.0	0.2	0.1	0.1	0.0
Multi-Project Support (MPS)	0.0	0.0	0.0	0.0	0.0	0.0
Total Direct Costs	**0.1**	**0.1**	**0.3**	**0.4**	**0.4**	**0.2**
Burden Costs	0.0	0.1	0.1	0.2	0.2	0.0
Total JPL Costs	**0.1**	**0.2**	**0.4**	**0.6**	**0.5**	**0.2**
Incentive Award	0.1	0.0	0.0	0.0	0.0	0.0
Total Estimated Cost	**0.2**	**0.2**	**0.4**	**0.6**	**0.5**	**0.2**
NOA	***0.3***	***0.3***	***0.3***	***1.0***	***0.3***	***0.0***

Cost inception to L+90 days
All Costs in Millions of Dollars (UPN 291)

ITEMS	For Information Only FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan
Workforce (Yrs)	0.0				
JPL Labor Costs	0.0				
Cat A Contractors	0.0				
Travel	0.0				
Services	0.0				
Procurements	0.0				
Subcontracts	0.0				
Multi-Project Support (MPS)	0.0				
Total Direct Costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Burden Costs	0.0				
Total JPL Costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Incentive Award	0.0				
Total Estimated Cost	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
NOA	***0.0***				

* Launch plus 90 days

Operations after L+90 days
All Costs in Millions of Dollars (UPN 291)

ITEMS	For Information Only FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan	Runout Total all Years
Workforce (Yrs)	0.0	0.0	0.0	0.0	0.0	7.9
JPL Labor Costs	0.0	0.0	0.0	0.0	0.0	0.7
Cat A Contractors	0.0	0.0	0.0	0.0	0.0	0.0
Travel	0.0	0.0	0.0	0.0	0.0	0.0
Services	0.0	0.0	0.0	0.0	0.0	0.2
Procurements	0.0	0.0	0.0	0.0	0.0	0.3
Subcontracts	0.0	0.0	0.0	0.0	0.0	0.3
Multi-Project Support (MPS)	0.0	0.0	0.0	0.0	0.0	0.0
Total Direct Costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.6**
Burden Costs	0.0	0.0	0.0	0.0	0.0	0.6
Total JPL Costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.2**
Incentive Award	0.0	0.0	0.0	0.0	0.0	0.1
Total Estimated Cost	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.3**
NOA	***0.0***	***0.0***	***0.0***	***0.0***	***0.0***	***2.3***

. Cost for Phase E

Table 9-4a Profile of TES Science (UPN 621) NOA and Cost

Cost inception to L+90 days
All Costs in Millions of Dollars (UPN 621)

	NASA-1260	NASA-1407				
ITEMS	Prior Actuals	FY'99 Actuals	FY'00 Actuals	FY'01 Actuals	FY'02 Plan	FY'03 Plan
Workforce (Yrs)						6.0
JPL Labor Costs						0.8
Cat A Contractors						0.0
Travel						0.0
Services						0.0
Procurements						0.1
Subcontracts						0.4
Multi-Project Support (MPS)						0.1
Total Direct Costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.5**
Burden Costs						0.4
Total JPL Costs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.8**
Incentive Award						0.0
Total Estimated Cost	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1.8**
NOA						***2.3***

- NOA FY'03-FY'08 reflects Mike King's guidelines sent April 2002

Cost inception to L+90 days
All Costs in Millions of Dollars (UPN 621)

	For Information Only				
ITEMS	FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan
Workforce (Yrs)	5.3				
JPL Labor Costs	0.9				
Cat A Contractors	0.0				
Travel	0.0				
Services	0.0				
Procurements	0.1				
Subcontracts	0.4				
Multi-Project Support (MPS)	0.1				
Total Direct Costs	**1.5**	**0.0**	**0.0**	**0.0**	**0.0**
Burden Costs	0.5				
Total JPL Costs	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**
Incentive Award	0.0				
Total Estimated Cost	**2.0**	**0.0**	**0.0**	**0.0**	**0.0**
NOA	***1.6***				

- Launch plus 90 days

Operations after L+90 days
All Costs in Millions of Dollars (UPN 621)

	For Information Only					
ITEMS	FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan	Runout Total all Years
Workforce (Yrs)	3.8	13.6	13.7	12.0	14.0	68.3
JPL Labor Costs	0.5	2.2	2.3	2.1	2.5	11.2
Cat A Contractors	0.0	0.0	0.0	0.0	0.0	0.0
Travel	0.0	0.0	0.0	0.0	0.0	0.0
Services	0.0	0.0	0.0	0.0	0.0	0.0
Procurements	0.0	0.1	0.1	0.1	0.1	0.7
Subcontracts	0.0	0.7	0.9	0.9	1.0	4.2
Multi-Project Support (MPS)	0.0	0.4	0.4	0.3	0.4	1.7
Total Direct Costs	**0.5**	**3.3**	**3.7**	**3.4**	**3.9**	**17.9**
Burden Costs	0.2	0.9	0.9	0.9	0.9	4.6
Total JPL Costs	**0.7**	**4.2**	**4.6**	**4.3**	**4.9**	**22.5**
Incentive Award	0.0	0.0	0.0	0.0	0.0	0.0
Total Estimated Cost	**0.7**	**4.2**	**4.6**	**4.3**	**4.9**	**22.5**
NOA	***1.2***	***4.4***	***4.6***	***4.3***	***4.2***	***22.5***

- Cost for Phase E

Table 9-le Profile of TES TOTAL PROJECT NOA and Cost

Cost inception to L+90 days
All Costs in Millions of Dollars (All UPNs)

ITEMS	NASA-1260 Prior Actuals	NASA-I 407 FY'99 Actuals	FY'OO Actuals	FY'01 Actuals	FY'02 Plan	FY'03 Plan
Workforce (Yrs)	1742	98 4	94 0	94 5	76 5	42.6
JPL Labor Costs	17 5	6 2	5 8	6 4	5 2	5 0
Cat A Contractors	3 2	101	1 1	091	091	10
Travel	03	03	02	0.2	01	01
Services	33	38	41	5.0	28	0.0
Procurements	1.5	14	20	4.0	05	0.4
Suhcnntrncts	250	227	94	32	38	21
Multi-Project Support (MPS)	-0.0	0.2	01	0.1	0.1	0.6
Total Direct Costs	50.8	35.4	22.7	**19.7**	**13.4**	**9.2**
Burden Costs	58.9	10 3	9 5	9 8	8.6	3 4
Total JPL Costs		45.7	**32.1**	**29.5**	22.0	**12.6**
Incentive Award	0 1	1 4	0.4	0 4	0 3	02
Total Estimated Cost	59.9	47.1	32.6	30.0	22.2	**12.8**
NOA	**59.5**	***55.6***	**29.0**	**30.8**	**18.1**	**13.3**

Cost inception to L+90 days
All Costs in Millions of Dollars (All UPNs)

ITEMS	FY'04 Plan	For Information Only FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan
Workforce (Yrs)	24.2	0.0	0.0	0.0	0.0
JPL Labor Costs	32	0.0	0.0	00	0.0
Cat A Contractors	01	00	0.0	00	00
Travel	01	00	0.0	00	00
Services	00	0.0	0.0	0.0	0.0
Procurements	0.4	00	0.0	0.0	0.0
Subcontracts	2.1	00	00	0.0	0.0
Multi-Project Support (MPS)	0.4	00	0.0	0.0	0.0
Total Direct Costs	**6.3**	**0.0**	**0.0**	**0.0**	**0.0**
Burden Costs	2.1	00	0.0	0.0	00
Total JPL Costs	**8.4**	**0.0**	**0.0**	**0.0**	**0.0**
Incentive Award	01	00	00	0.0	00
Total Estimated Cost	8.5	0.0	0.0	0.0	0.0
NOA	**6.8**	**0.0**	**0.0**	**0.0**	**0.0**

• Launch plus 90 days

Operations after L+90 days
All Costs in Millions of Dollars (All UPNs)

ITEMS	For Information Only FY'04 Plan	FY'05 Plan	FY'06 Plan	FY'07 Plan	FY'08 Plan	Runout Total all Years
Workforce (Yrs)	13 0	30 4	27 3	23 3	22.7	714.5
JPL Labor Costs	1.7	4 5	4 2	3 7	3.7	66 4
Cat A Contractors	0.1	0 2	0 2	0 2	0 2	8 9
Travel	0 0	0 1	0 1	0 1	0.1	1.6
Services	0 0	0 0	0 0	0.0	0 0	19.0
Procurements	0 0	0 2	0 2	0 2	0 2	10 7
Subcontracts	0 0	1 3	1 5	1 2	1 2	73 4
Multi-Project Support (MPS)	0 2	0 7	0 7	0 6	0 6	4.5
Total Direct Costs	**2.0**	**7.1**	**6.8**	**5.9**	**5.8**	***184.6***
Burden Costs	0.6	2 0	1.8	1.6	1.4	59.3
Total JPL Costs	2.6	**9.1**	8.6	7.5	7.2	243.8
Incentive Award	0 0	0 1	0 1	0 0	0 0	3 2
Total Estimated Cost	2.7	**9.1**	**8.7**	**7.5**	**7.3**	***247.1***
NOA	**4.2**	**8.8**	**8.6**	**7.4**	**6.2**	***247.1***

* Cost for Phase E

* Carryover obligation authority at the start of a new fiscal year will be sufficient to fund the TES Project at the required obligation rate until funds for the new fiscal year are on contract at JPL, assumed for planning purposes to be the first ten weeks of the government fiscal year.

** NOA W/O Reserve is calculated as follows: planned current year obligation + carryover (to) - carryover (from)

† The funding shown is consistent with the implementation plan which forms the basis for this Task Plan. However, both JPL and GSFC recognize the uncertainty of future year funding authority and would anticipate re-negotiation of the scope of the implementation plan and funding profiles in this Task Plan if the NOA is adjusted. In addition, obligation authority actually provided to JPL in each fiscal year will be assessed and adjusted based upon actual cost performance during each fiscal year.

† The Science/CalVal and SCF funding shown is consistent with the yearly guideline direction provided by M. D. King, EOS Senior Project Scientist, which forms the basis for this Task Plan. However, both JPL and GSFC recognize the uncertainty of future year funding authority and would anticipate re-negotiation of the scope and funding profiles in the Task Plan if the NOA is adjusted. In addition, obligation authority actually provided to JPL in each fiscal year will be assessed and adjusted based upon actual cost performance during each fiscal year.

The funds are divided into two categories:

1) NOA/Obligation/Cost Plan Funds -- covers the work effort as defined in this Working Agreement and understood on the date of this Working Agreement.

2) Reserve Funds -- covers problem resolution, rework, underestimates, overhead rate changes, and TES-initiated scope changes that could not be identified at the time of this Working Agreement.

The TES project will establish a management reserve tracking system that will identify liens and encumbrance of this reserve and will provide detailed reporting to GSFC. In managing this effort, JPL will not rely exclusively on reserve funds to solve all cost problems. JPL will periodically identify descope options which could be taken to reduce costs or re-gain schedule. Identified descope options will be presented at PDR, CDR, and PER. JPL and GSFC will jointly decide if and when any of these descope options will be implemented.

JPL will use reserve funds to cover any negotiated increase in scope initiated by JPL/TES. However, JPL will receive additional funding to cover any significant increases in scope initiated by NASA/GSFC/EOS Aura Project. Changes initiated by JPL that impact the Spacecraft will be presented to GSFC for review and concurrence, and the associated spacecraft costs will be paid for by TES. The point of reference for such changes will be the UIID baseline (Applicable Document No.3). Periodic reviews may be held by GSFC to assess the availability of prior year unused reserves for reallocation.

JPL will inform GSFC on a monthly basis of JPL's funding status with respect to actual cost performance and outstanding obligations, including use of reserve.

JPL and GSFC will jointly work to minimize uncosted funding at the end of each FY. Specifically, at the end of each FY:

1. JPL will so develop its obligation and cost plan that it will carry forward uncosted funding to cover funding needs (workforce, travel, services, etc.) of only the first 10 weeks of the government fiscal year.

2. JPL contracts in force at a fiscal year boundary will be so planned and managed that incremental funding available to the contractor will extend for no more than 90 days beyond the start of the new government fiscal year.

3. As necessary and feasible within technical and schedule constraints, JPL will:

    - Minimize obligations for new procurements during the first 10 weeks of the government fiscal year.

    - Move planned future year work into the current year to recover under-costing of the cost plan.

    - Move planned current year work into future years to recover over-costing of the cost plan.

In addition, at the end of the third fiscal quarter of each year, GSFC and JPL will jointly evaluate the TES Project fiscal needs and cost performance through the first three quarters with the intent of adjusting (decreasing or increasing) the NOA available to the Project to minimize uncosted funds as outlined above while still maintaining schedule commitments

9.2 Technical Resources

JPL will track, and regularly report to GSFC, mass, power and data rate resources allocated to the instrument with a current best estimate (CBE), associated uncertainty, and available reserves (margin) at the instrument level and at lower level assemblies. JPL will maintain minimum resource reserves in addition to CBE and uncertainty, which will be of a size that decreases as the design matures; GSFC and JPL will mutually determine this profile of reserve vs. time. Options to reduce required resources will be developed, maintained and regularly reported at reviews with GSFC with the intent that they be exercised to such extent as may be necessary to maintain the required reserve. The TES budget will be adjusted during the Program Operating Plan (POP) process each year. This working agreement will be updated periodically to reflect the agreed budgeted amounts contained in the POP. In the interim, the POP budgets will govern.

10. Point of Contact

The GSFC Instrument Manager and the JPL Project Manager will be the single point of contact within their respective organizations for the coordination, negotiation and resolution of programmatic requirements and issues between JPL and GSFC.

II. Period of Performance

The contractual period of performance is from September 21, 1998 through September 28, 2003. The programmatic period of performance February 8, 1990 through April 24, 2004.
It is recognized, however, that the "contractual" period of performance for the portion of the task performed under Contract NAS7- 1407 ends September 28, 2003. This task will be performed in accordance with the programmatic end date contingent upon award of the successor NASA/Caltech contract.

12. Changes to this Agreement

Subsequent to acceptance and signing of this Working Agreement by the responsible parties, the Working Agreement may be changed or amended at any time with the bilateral agreement of the TES Project and the EOS Aura Project. The EOS Aura Project configuration control system, established by EOS Aura Project in accordance with the EOS Configuration Management Plan (420-02-02), will be used as a vehicle for processing such changes in an orderly manner.

ACRONYMS AND ABBREVIATIONS

AHSE	Assembly, Handling, Shipping and Storage Equipment
C&DH	Command and Data Handling
CBE	Current Best Estimate
CDR	Critical Design Review
DRL	Document Requirements List
EEPROM	Electrically Erasable PROM
EGSE	Electrical GSE
EM	Engineering Model
EOS	Earth Observing System
ESFE	Earth Science Flight Experiments
FPGA	Field Programmable Gate Array
GBL	Government Bills of Lading
GFE	Government Furnished Equipment
GIRD	General Interface Requirements Document
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
I&T	Integration and Test
ICD	Interface Control Document
IGSE	Instrument Ground Support Equipment
JPL	Jet Propulsion Laboratory
MAR	Mission Assurance Requirements
MGSE	Mechanical GSE
MLS	Microwave Limb Sounder
NASA	National Aeronautics and Space Administration
NOA	New Obligation Authority
PDR	Preliminary Design Review
PER	Pre Environmental Review
PFM	Protoflight Model
PMR	Project Management Report
PROM	Programmable Read Only Memory
PSR	Pre Ship Review
SCR	System Concept Review
SIIS	Spacecraft-Instrument Interface Simulator
TBD	To Be Determined
TBR	To Be Resolved
TES	Tropospheric Emission Spectrometer
UIID	Unique Instrument Interface Document
UPN	Unique Project Number